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Materiel Test Procedure 6-3-037(H)
U. S. Army Aviation Test Board

14 January 1971

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

TARGET DETECTION AND ACQUISITION DEVICES

1. OBJECTIVE

This document provides existing test methods and techniques necessary to determine the degree to which airborne target detection and acquisition systems and their associated tools and test equipment (maintenance package) meet the requirements stated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), or Technical Characteristics (TC); and whether or not the system is suitable for Army use.

2. BACKGROUND

a. Army aircraft utilized in missions such as surveillance and support for ground operations will be enhanced from a tactical military standpoint when they are equipped with target detection and acquisition devices. These systems allow flight personnel to determine the presence and positions of targets, analyze their characteristics, track motion and direct weapons fire. These functions would be impossible when visual sightings become restricted. Targets can be landmarks, vehicles, personnel, encampment, storage areas, etc.

b. The basic components of a system of this type are:

- 1) Illuminator (transmitter) - generates the electrical signal to be transmitted.
- 2) Antenna - Shapes and directs the transmitter energy and collects reflected or target emitted energy.
- 3) Receiver - processes information contained in received energy.
- 4) Display - provides target information in some desired form (position, size, etc.) to personnel.

c. A major subdivision occurs in this class of systems when there is - or is not - a transmitter. Systems with transmitters are classed as active; those without are passive. In operation, the system receiver collects either reflected transmitter energy or energy emitted directly by the target, e.g., infrared. Typical examples of system types include:

- 1) Low light level television (LLLTV).
- 2) Laser systems.
- 3) Microwave (radar).
- 4) Infrared (side, forward, and downward looking).

d. Within the class of target detection and acquisition systems, there is a wide range in the technical and operating characteristics of a given system. In general, an individual system is designed, and will have

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been selected for, applications involving targets and conditions for which it is expected to be most effective. However, for the purpose of determining what test procedures and conditions should be utilized in formulating a test plan, it is desirable to consider the subject as divided into three aspects: the system and its characteristics, the medium between the system and targets and its effects on propagation, and the target/target background combination characteristics and effects. These aspects will be treated in detail during operational tests. The primary intent, however, for the service test of these systems will be to show that the system provides reliable and accurate target information while operating through various mediums against targets with varying characteristics against different backgrounds. Testing of the system also must ensure reliability and safety since the system will be exposed to many different environments while the aircraft is involved in flight procedures. Other factors such as flexible installation and physical characteristics rendering the system suitable for use on different aircraft also will be examined. The total testing program shall verify the suitability of the device for use by the Army.

3. REQUIRED SUPPORT

3.1 FACILITIES

- a. Avionics-maintenance facility.
- b. Flight test ranges which include various types of terrains and targets.
- c. Radio communications network.
- d. Availability of a meteorological station.

3.2 EQUIPMENT

Appropriate number and types of test bed aircraft.

3.3 PERSONNEL

Personnel in appropriate numbers, of the proper MOS, grade, skill level, and with special training as required.

4. REFERENCES

- A. AR 385-16, Safety: Safety for Systems, Associated Subsystems, and Equipment.
- B. USATECOM Regulation 70-23, Research and Development: Equipment Performance Reports (EPRs).
- C. USATECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports.
- D. USATECOM Regulation 108-1, Photographic Coverage. (As implemented by USAVNTBD Memo 108-1).
- E. USATECOM Regulation 385-6, Safety: Verification of Safety of Materiel During Testing. (As implemented by USAAVNTBD Memo 385-10).

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- F. USATECOM Regulation 750-15, Maintenance and Supplies and Equipment: Maintenance Evaluation During Testing. (As implemented by USAAVNTBD Memo 750-2).
- G. MIL-STD-882, System Safety Program for Systems and Associated Subsystems and Equipment: Requirements for.
- H. MTP 6-2-222, Radar, Target and Ranging.
- I. MTP 6-3-501, Pre-Test Inspection for Service Test.
- J. MTP 6-3-502, Personnel Training Requirements.
- K. MTP 6-3-513, Qualitative Electromagnetic Interference.
- L. MTP 7-3-500, Physical Characteristics.
- M. MTP 7-3-502, Installation Characteristics.
- N. MTP 7-3-506, Safety.
- O. MTP 7-3-507, Maintenance.
- P. MTP 7-3-508, Reliability.
- Q. MTP 7-3-509, Compatibility with Related Equipment.
- R. MTP 7-3-510, Human Factors.
- S. MTP 7-3-514, Adequacy of Technical Manuals.
- T. MTP 7-3-515, Photographic Coverage.
- U. QMR, SDR or TC for the system under test.

5. SCOPE

5.1 SUMMARY

This document provides existing procedures for evaluating the characteristics of target detection and acquisition systems installed on Army aircraft. The procedures comprising the testing program are summarized below.

5.1.1 Preparation for Test

This section provides guidance for project planning and procedures for the training of test personnel.

5.1.2 Test Conduct

The procedures to be utilized in conducting each subtest are contained in this section. The following will be conducted on target detection systems.

a. Inspection - A series of preliminary tests to determine that the system is in satisfactory condition prior to the operational tests.

b. Installation - An evaluation of installation requirements including placement and removal procedures, stability of mounting, the flexibility for use on various aircraft.

c. Operation and Performance - A determination of the operation and performance characteristics of the system under conditions which most nearly simulate those expected to be encountered in the field.

d. Durability - To evaluate the time in service, failure potential of components, and operational durability limits of target detection and acquisition systems.

e. Maintainability - To determine the suitability of the complete system for accomplishing scheduled and nonscheduled maintenance tasks over the entire period of service testing stated in terms of maintenance downtime and mean time to repair.

f. Reliability - To determine the mission reliability of the complete system in terms of failure-free operation time and mean time between failures.

g. Maintenance Evaluation - To determine the maintenance characteristics of target detection and acquisition devices and the adequacy of the tools, test equipment and technical manuscripts and manuals.

- 1) Maintenance Characteristics - To determine the adequacy of test points, monitor construction and accessibility of components to provide ease of maintenance.
- 2) Tools and Test Equipment - To determine the adequacy of common and special tools and test equipment to perform the specified maintenance and repair functions.
- 3) Draft Technical Manuals - To determine whether the draft technical manuals are clear, accurate, and complete.

h. Compatibility - An evaluation of the effects and interactions of the system with the established configuration of the aircraft and its mission profiles. This is a measure of the degree to which requirements for the instrument differ from, require special consideration for, or interfere with tactical procedures, equipment, tools, and materials.

i. Safety - An evaluation which identifies and examines hazardous characteristics of the design and operating procedures of the system; the objective is to eliminate personnel injury, materiel failures, malfunction and equipment losses.

j. Human Factors - An evaluation to determine the adequacy of the design and performance characteristics in terms of compatibility with specified user personnel in the operational environment to achieve effectiveness, simplicity, efficiency, reliability, and safety of system operation, training and maintenance. Characteristics as related to human factors and revealed during the conduct of each test shall be examined.

k. Personnel and Training Requirements - An evaluation which, through observation of personnel involved in operation and maintenance procedures, will be utilized to determine the adequacy and sufficiency of training an appropriateness of skill levels and experience specified for the selected test personnel.

5.1.3 Test Data

This section details the data to be collected and recorded while completing the test procedures in paragraph 6.2, Test Conduct.

5.1.4 Data Reduction and Presentation

This section provides instructions for evaluating and displaying the data recorded during testing.

5.2 LIMITATIONS

This MTP is intended to be used as a basic guide in preparing test plans for the subject equipment. The procedures specified are applicable to service test of airborne target detection and acquisition systems. Since the usage and design of these systems cover such a wide range, the operation and performance procedures have been presented in a general way so as to allow for satisfactory evaluation of systems of all types. The use of particular procedures will be determined by the applications. Also, the pertinent QMR, SDR, TC and other applicable documents will be utilized to derive test criteria and to formulate test conditions.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Test Planning

Utilize reference 4.C to formulate the plan of test. Certain general procedures to be followed in the generation of a test plan follow:

- a. Review the test directive to determine test objectives.
- b. Determine criteria for the tests by reviewing QMR, SDR, and TC for the system to be tested and other applicable sources containing test criteria germane to the system.
- c. Become familiar with the system's technical and operational characteristics.
- d. Prepare a detailed test schedule showing proposed time periods allotted for each test listed in paragraph 5.1.2. Where possible, allow sufficient time to evaluate durability and reliability characteristics.
- e. Plan to use photographic techniques where possible to record and document findings and results of testing. References 4.D and 4.T shall be consulted for procedures.

f. Incorporate the proper safety precautions into all test procedures and secure any specified special safety devices required for personnel involved in testing.

6.1.2 Support

Review the support requirements of paragraph 3, and any additional support determined while ascertaining test criteria. Analyze these requirements with respect to availability and scheduling.

6.1.3 Personnel

a. Select test personnel of the proper MOS with varying skill levels and backgrounds for the determination of optimum user and maintenance types.

b. Train test personnel to operate and maintain the equipment using the draft literature.

c. Determine qualification in accordance with the requirements of reference 4.J; in particular, ensure that test personnel are aware of test objectives and knowledgeable in the procedures to be utilized.

6.2 TEST CONDUCT

6.2.1 Inspection

6.2.1.1 Inventory Check and Visual Inspection

Perform the following:

a. An inventory check against the Basic Issue Item List (BIIL), submitting an EPR for each noted shortage or discrepancy in accordance with the provisions of reference 4.B.

b. Pre-test inspection procedures required by reference 4.I; in particular-

- 1) Visually inspect for defects.
- 2) Remove all preservatives.
- 3) Verify lubrication required.
- 4) Check for completeness of assembly.

6.2.1.2 Physical Characteristics

Physical characteristics shall be determined by performing the applicable sections of reference 4.L, in particular the following:

a. Note the legibility and effectiveness of markings, legends, etc.

b. Determine the dimensions, weight, and volume of all assembly components.

c. Compute the system's total weight and volume.

d. Photograph all components before and after installation.

6.2.1.3 Technical Characteristics

Examine the following technical properties (as applicable):

a. Power requirements - Verify circuitry and measure the electrical power requirements of the system. Check that the system operates satisfactorily over the range specified in supply voltages by varying the supplies and noting performance.

b. Controls, adjustment and indicators (mechanical and electrical); determine the following as appropriate:

- 1) Operation.
- 2) Effect on the system.
- 3) Adequacy of movement.
- 4) Proper calibration.
- 5) Changes are monitored and displayed correctly.
- 6) Range and sensitivity.

Evaluations requiring flight will be conducted during the Operation and Performance Test.

c. Equipment safety and protective devices - Determine adequacy.

d. Fail-Safe Characteristics - Examine the system for the following:

1) Internal failure - When the system becomes inoperative because of internal failure, operator personnel shall be made aware of the condition. When possible, simulate failures and determine suitability of all fail-safe features.

2) Acceptance or provision of external signals - If the system accepts/provides electrical signals from/to other on-board avionics equipment, operator personnel shall be made aware of any out-of-limit level existing on any line. Simulate failures on each line and determine the adequacy of fail-safe indications.

e. Confidence, self-checking or integrity circuits, if any - Verify proper operation.

f. Primary Technical Characteristics - Measure the transmitter characteristics (frequency, power, repetition rate, pulse characteristics, etc.) and receiver characteristics (sensitivity and bandwidth).

g. Cold start and warm-up - Subject the system to the required number of cold start power application procedures. Determine warm-up and effects due to multiple power applications.

6.2.2 Installation

Evaluate the installation requirements of the system utilizing the requirements of reference 4.M, including the following:

a. Determine installation requirements (time, effort, tools, materials, personnel, instructions, etc.). Record recommendations for improvements.

b. Ensure that the system is secure, protected against shock and vibration, and, in general, mechanically stable.

c. Determine mounting requirements for use on various types of aircraft.

d. Photograph the pertinent installation procedures.

6.2.3 Operation and Performance

6.2.3.1 Conditions and Preparations for Test

a. Operate the system over as wide a range of weather conditions as possible during the test period.

b. Plan for the use of suitable communications networks, ground tracking stations and meteorological facilities as required.

c. Utilize altitudes and airspeeds consistent with aircraft capabilities and system requirements.

d. The system under test and other associated on-board systems shall receive an operational check prior to each test flight.

6.2.3.2 Detection/Acquisition/Tracking

a. Determine the system's ability to detect targets.

b. Use a target of the type which the system is to detect.

c. Fly toward, over, or by the target (as the system is either forward, downward, or side looking in nature).

d. Note system performance; in particular, the display characteristics, during the period that the target is displayed.

6.2.3.3 Maximum System Range

- a. Utilizing the same targets of procedure 6.2.3.2, determine the maximum range (or maximum detection altitude in the case of downward-looking systems).
- b. Fly straight line flights at or over targets increasing the distance-to-target until the target is not distinguishable and note the distance or altitude.

6.2.3.4 Target Positional Accuracy

- a. Determine the system's ability to provide accurate coordinate information on targets, e.g., range to, angle with respect to aircraft axis, etc.
- b. Conduct flights over a surveyed course which includes precisely located landmarks, and targets the position of which with respect to these landmarks is known.
- c. Fly various altitudes and angular ground tracks with respect to the targets so that on passage over landmarks, display information can be compared with actual target coordinates (corresponding to the flight conditions, e.g., altitude and angle, and taken with respect to the landmark).

6.2.3.5 Target Resolution

- a. Determine the system's ability to resolve and adequately display targets in multiple configuration, i.e., targets of the same or varying size, shape, etc. with different separations. Include targets which will allow for elevation, azimuth and range resolution, as appropriate.
- b. Fly, at constant barometric altitude, approaches to or over the target groups and determine the range or altitude at which separation or resolution occurs.
- c. Utilize photographic recording of displays during target approach to document the sequential resolving process.

6.2.3.6 Field of Coverage

- a. Determine the extent and accuracy of the system field of coverage, i.e., the system displays indicated position of a target compared to the actual position (at the maximum of each coordinate available on the display). Include the following where appropriate:
 - 1) Maximum elevation above and below aircraft axis.
 - 2) Azimuth left and right of aircraft axis.
 - 3) Angular or circular field of coverage in the plane below the aircraft.

b. Conduct straight and level flights at various angles and altitudes which should place targets at the extremity of each display coordinate. Accurate aircraft position information is required.

6.2.3.7 Target Characteristics/Environment

a. Operate the system against various representative military targets to determine capabilities and limitations of the system as related to variations in target characteristics and their environment and backgrounds.

b. Include the following types of targets in the tests:

- 1) Boats.
- 2) Aircraft.
- 3) Trains.
- 4) Man-made structures.
- 5) Troop concentrations and encampments.
- 6) Military vehicles.

c. Vary the target characteristics and backgrounds to determine effects on system performance and displays. Include the following:

- 1) Moving and fixed.
- 2) Target temperatures.
- 3) Background terrains.
- 4) Camouflaged and uncamouflaged.
- 5) Targets varying in number, geometry, and spacing.
- 6) Targets of different materials.

6.2.3.8 Displays

Document the following, using photographic techniques or some other suitable method of recording:

- 1) Stability/distortion.
- 2) Readability.
- 3) Definition and resolution.
- 4) Correlation of display with known target characteristics.

6.2.3.9 Effects of Atmospheric Conditions

a. Repeat selected tests during periods when changes in atmospheric conditions exist. Include the following, as appropriate:

- 1) Sunrise and sunset.
- 2) Electrical storms.
- 3) Nocturnal hours.
- 4) Poor weather, poor visibility (rain, fog).
- 5) High and low temperatures.

b. Note the following:

- 1) Changes in area coverage, accuracy, range, etc.
- 2) Changes in display of targets.

6.2.3.10 Effects of Geographic Surface Conditions

a. Conduct tests, day and night over various types of surfaces, e.g., the following:

- 1) Water-land interfaces.
- 2) Isolated bodies of water.
- 3) Mountain ranges.
- 4) Areas with varying types and degrees of vegetation.

b. Note the following:

- 1) Changes in the quality of the displays.
- 2) Any changes in the ability of the system to obtain targets.

6.2.3.11 Tactical Missions

Perform the following:

a. Evaluate the system as an aid to the conduct of tactical operations through simulation. Include, where possible, during day and night, the following operations:

- 1) Reconnaissance and surveillance.
- 2) Rendezvous with ground units.

b. Record aircrew's comments on the effectiveness of the system.

6.2.4 Durability

On completion of the Operation and Performance tests, the durability characteristics of the system will be examined. Perform the following:

a. A visual inspection with consideration given to-

- 1) Loose chassis components.
- 2) Loose or missing hardware.
- 3) Broken fasteners or seams.
- 4) Discoloration due to heat effects, rust, or corrosion.
- 5) Loose panel components.
- 6) Loose connectors or cables.

For each defect, the nature and location shall be noted.

b. A re-measurement of primary technical characteristics to determine any degradation.

c. An examination of equipment failures, isolating those which are attributal to lack of durability.

6.2.5 Maintainability

a. Throughout the testing, record the performance of scheduled and unscheduled maintenance as prescribed in the appropriate maintenance instructions. Assess all maintenance factors in accordance with reference 4.0, including maintenance downtime and mean time to repair.

b. Compare all replacement parts and components provided with the target detection and acquisition devices with anticipated and actual requirements and evaluate repair parts requirements under actual operating conditions.

c. Record the requirements for additional tools and instruments, shortcomings in authorized tools and instruments, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

d. Record all repair parts used, man-hours and elapsed time, and level of skill required.

6.2.6 Reliability

Starting with the initial setup and checkout of target detection and acquisition devices, maintain a complete log of all assembly, installation, operation, disassembly, and maintenance activities for the purpose of reliability analysis in accordance with reference 4.P. The log shall include the following information:

a. Hours of operation, daily and cumulative.

b. Equipment failures and malfunctions, including chronological data required to determine failure-free operating time and mean time between failures.

c. Effect of failures on the operational test conduct.

6.2.7 Maintenance Evaluation

Evaluate the maintenance characteristics of target detection and acquisition devices as required by the QMR or SDR. In particular, throughout the conduct of service tests, personnel of appropriate MOS levels and varying proficiencies shall perform all maintenance functions listed in the draft technical manual and the following:

6.2.7.1 Maintenance Characteristics

a. Evaluate the adequacy of test points, modular construction and accessibility of components to provide ease of maintenance of target detection and acquisition devices.

b. Report any maintenance difficulties experienced resulting from lack of test points, inadequacy of construction or inaccessibility of components and provide suggested improvements when applicable.

6.2.7.2 Tools and Test Equipment

a. Indicate the adequacy of the common and special tools for the performance of the specified maintenance and repair functions.

b. Indicate the suitability of the test equipment for the performance of established testing functions, necessary support equipment maintenance and calibration, if required.

6.2.7.3 Draft Technical Manuals

a. Evaluate the adequacy and simplicity of the draft technical manuals for the intended maintenance level as specified in reference 4.S.

b. Verify the technical documentation against the system for completeness, accuracy, clarity, and ease of use.

c. Report any difficulties experienced - errors, and/or omissions - and provide suggested changes or improvements to the maintenance test package when applicable.

6.2.8 Compatibility

During testing, consideration should be given to compatibility of the system with the operating environment. Problems such as operational interference with adjacent electronic systems shall be determined.

Perform the following:

a. Review during all procedures the problem of compatibility.

b. Note any instances of incompatibility using the following list as a guide.

- 1) Preparation for Use - Note the need during installation for special tools, hardware, mounting brackets, etc. and nonstandard size or overweight items.
- 2) Operation and Performance - Note during the operational procedures whether or not the system interferes with or is itself interfered with by other on-board or ground-

based electronic systems. This can be accomplished by operating the system simultaneously with other on-board electrical systems and in the presence of various types of radio frequency fields generated by ground installations. Compatibility of the system with other on-board electronic systems utilizing signals from or providing signals to the test system will be determined. The requirements of reference 4.K also will be satisfied.

6.2.9 Safety

This test is to identify and examine hazardous characteristics and features of the system. The requirements of references 4.N and 4.E shall apply.

Perform the following:

- a. The procedures required by reference 4.N.
- b. Observe the proper safety precautions and adhere closely to the draft manual's directives which deal with safety an/or protection.
- c. Examine the procedures for all tests. Report any hazard to the project officer.
- d. Examine the characteristics of the system including the procedures for its operation and maintenance to ensure that maximum safety has been provided. Consider the following:
 - 1) Examine operating procedures with a view that improperly executed or misinterpreted instructions could result in bodily harm or equipment damage.
 - 2) Where hazardous conditions cannot be avoided, is the item properly and conspicuously marked for the conditions?
 - 3) Are all moving parts shielded and completely enclosed?
 - 4) Where electrical power is utilized, are the electrical circuits guarded against accidental contact?
 - 5) Are any environmental limitations explicitly denoted?
- e. Determine the adequacy of all protective and warning devices. Consider the following:
 - 1) Overheat devices.
 - 2) Overload protection.
 - 3) Locking mechanisms.
 - 4) Limit switches.
 - 5) Visual and audible warning devices.
 - 6) Interlocks.

NOTE: Safety confirmation shall comply with the requirements of reference 4.E.

6.2.10 Human Factors Evaluation

This evaluation is designed to determine the degree to which the design and performance satisfy accepted standards for human factors. Applicable document is reference 4.R. The evaluation will be conducted by preparing a human factors task and characteristics analysis checklist. The purpose of the checklist is to rate, from a human factors standpoint, the tasks associated with, and the characteristics revealed during the procedures for preparing, operating, transporting, and maintaining the system. The rating will be either satisfactory or unsatisfactory with explanatory information accompanying an unsatisfactory rating. The ratings may be made simultaneously with the above listed evaluation or separately. For all tasks/characteristics the following will be considered:

- a. Ease of performance - Mental and physical effort required.
- b. Support - Adequacy of instructions and tools for the task.
- c. Time required - Modification of procedures to reduce time required.
- d. Design characteristics - Effects on performance of tasks.

Perform the following:

- 1) The procedures required by reference 4.R.
- 2) Rate the following tasks/characteristics for the evaluation listed.
 - a) Preparation for Use.
 1. Assemble components, move to installation location, place in position, make external connections, and lock into position with fasteners, connectors, etc.
 2. Apply power, check controls and indicators. Make required alignment, calibrate, and adjust.
 - b) Operation and Performance.
 1. Operate controls, note changes in equipment status, monitor other displays. Evaluate interface between the target detection and acquisition system controls and indicators and the aircraft controls and indicators.
 2. Note legends, their effectiveness, readability, visibility.
 3. Note performance, operation and system status feedback to operator (auditory, visual, etc.).

4. Night operation - adequacy of the target detection and acquisition system control and indicator lights and interface with cockpit lighting scheme.

c) Maintenance.

1. Perform preventive maintenance.

- a. Clean, add lubricants.
- b. Remove and replace minor items.
- c. Tighten fasteners, connectors.
- d. Adjust, calibrate, align.

2. Perform nonscheduled maintenance.

- a. Detect malfunction by observing displays, noting visual or audible changes, or changes in operating effectiveness.
- b. Isolate and identify causes by visual means or instrumentation.
- c. Open, gain access to, and remove component.
- d. Replace or repair and re-establish proper operation.

6.2.11 Personnel and Training Requirements

Perform the following:

a. Utilize personnel of varying skill levels and experience throughout the test program to determine the optimum personnel type.

b. Review the performance of personnel during the operational and maintenance procedures paying particular attention to mistakes or errors made in operational procedures and excessively long maintenance tasks.

c. Review the effects of the training programs as to their adequacy, etc., noting also any additional training required during the test and suggestions for changes to the training program.

d. Make a quantitative estimate as to the average number of training hours required for both operational and maintenance personnel.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.2 Test Conduct

6.3.2.1 Inspection

6.3.2.1.1 Inventory Check and Visual Inspection-

Record the following:

- a. The data required by reference 4.I.
- b. Physical defects.
- c. Completeness of the Basic Issue Item List.

6.3.2.1.2 Physical Characteristics-

Record the data required by reference 4.L and the following:

- a. Equipment markings.
- b. Dimension, volume, and weight data fro all components and total system weight and volume.

6.3.2.1.3 Technical Characteristics-

Record the following:

- a. Electrical incompatibility and power requirements.
- b. Controls and indicators.
 - 1) Improper operation.
 - 2) Calibration.
 - 3) Monitoring and display of system conditions.
- c. Operation of safety devices.
- d. Operation of fail-safe features.
- e. Operation of self-checking features.
- f. Warm-up time.

6.3.2.2 Installation

Record the following:

- a. The data required by reference 4.M.
- b. Time required.
- c. Skill level required.
- d. Problems encountered.

6.3.2.3 Operation and Performance

6.3.2.3.1 Conditions and Preparations for Test-

Record the following:

Procedures followed in pre-flight checkout.

6.3.2.3.2 Detection/Acquisition/Tracking-

Record the following:

- a. The type of target utilized.
- b. Any problems in acquiring the target.
- c. Flight procedures utilized.

6.3.2.3.3 Maximum System Range-

Record the maximum range or altitude at which the system is effective.

6.3.2.3.4 Target Positional Accuracy-

Record the following:

- a. Details of the test course and target information.
- b. For each flight conducted, the aircraft altitude, flight direction, display coordinate data at each checkpoint and actual target coordinate data.

6.3.2.3.5 Target Resolution-

Record for each flight conducted, the altitude, heading, speed, and description of the target utilized and distances at which resolution occurs.

6.3.2.3.6 Field of Coverage-

Record for each flight the position of the aircraft when targets are lost at the extremities of the display.

6.3.2.3.7 Target Characteristics/Environment-

Record the following:

- a. For each test, the flight procedures, target characteristics, and background.

- b. Variations in displays.

6.3.2.3.8 Displays-

Record the following:

- a. Comments on the general effectiveness of displays.
- b. Correlation of display with targets.
- c. Suggestions for improvements.

6.3.2.3.9 Effects of Atmospheric Conditions-

Record for each of the test flights details of weather conditions at the time, comments regarding the effectiveness of the system and any difficulties experienced.

6.3.2.3.10 Effects of Geographic Surface Conditions-

Record the following:

- a. Complete details of each flight conducted.
- b. Comments regarding system effectiveness and any loss of performance characteristics.

6.3.2.3.11 Tactical Missions-

Record the following:

- a. Description of each mission procedure performance.
- b. Summary of comments from all aircrewmembers regarding the system's performance.

6.3.2.4 Durability

For the visual inspection, record the nature and location of the following:

- a. Loose components, hardware, connectors.
- b. Discolorations.
- c. Broken or frayed components.

6.3.2.5 Maintainability

Record the following:

- a. Data as specified in reference 4.0 including maintenance downtime and mean time to repair.
- b. Performance of scheduled and unscheduled maintenance.
- c. Requirements for additional tools, the shortcomings of furnished tools, and needs for specialized tools and instruments not furnished.
- d. Repair parts used, man-hours to install and level of skill required.

6.3.2.6 Reliability

Record the following:

- a. Data as specified in reference 4.P.
- b. Hours of operation, daily, and cumulative.
- c. Equipment failures and malfunctions, including chronological data required to determine failure-free operating time and mean time between failures.
- d. Effects of failures on the operational test conduct.

6.3.2.7 Maintenance Evaluation

Record data required by the applicable QMR, SDR and the following:

6.3.2.7.1 Maintenance Characteristics-

- a. Comments on the adequacy of test points, modular construction and accessibility of components for ease of maintenance.
- b. Any maintenance difficulties experienced and suggested improvements, if applicable.

6.3.2.7.2 Tools and Test Equipment-

- a. Adequacy of tools and test equipment in performance of assigned tasks.
- b. Adequacy of test equipment without unscheduled maintenance or calibration.

6.3.2.7.3 Draft Technical Manuals-

- a. Adequacy and simplicity of draft technical manuals as specified in reference 4.S.
- b. Accuracy, completeness, and clarity of the technical documentation.
- c. Suggested changes to the maintenance test package as a result of the service tests.

6.3.2.8 Compatibility

Record the data required by references 4.Q and 4.K and instances of the following:

- a. Physical or electrical characteristics not compatible with system capabilities.
- b. System interferes or is interfered with by other equipment generating, utilizing, or radiating electrical energy.
- c. System compatibility with existing electronic equipment.

6.3.2.9 Safety

Record data required by reference 4.N and the following:

- a. Comments regarding hazardous conditions found in the procedures of any test.
- b. For general safety characteristics:
 - 1) Poorly worded or unclear operating instructions.
 - 2) Warning labels - lacking, not conspicuous.
 - 3) Unprotected electrical circuits.
 - 4) Markings of environmental limitation missing.
- c. Prepare a table to include the following:
 - 1) A list of all safety devices utilized.
 - 2) The type of failure each device is to detect.
 - 3) Indication that the device has successfully operated.
- d. List any missing devices or unsafe conditions.
- e. List any suggested additions to the safety features.
- f. Prepare a safety confirmation statement.

6.3.2.10 Human Factors Evaluation

Record the data required by reference 4.R and, in addition, complete the checklists prepared for the tasks of the procedures for preparing, operating, maintaining, and transporting the system. Rate each task as satisfactory or unsatisfactory from a human factors standpoint. In rating each task consider and record instances of the following:

- a. Instructions.
 - 1) Lacking clarity.
 - 2) Insufficient or excessive detail.
- b. Tools.
 - 1) Proper tools not supplied.
 - 2) Excess of special tools specified.
 - 3) Additional tools recommended.
- c. Mental and Physical Effort.
 - 1) Above average skill or strength required of test personnel.
 - 2) Task is excessively tiring.
- d. Design.
 - 1) Poor location of component.
 - 2) Component not accessible.
 - 3) Visibility hindered.
 - 4) Adequacy of controls, adjustments, etc.
- e. Time required for task (if excessive, reasons why).
- f. Personnel requirements.
 - 1) Insufficient number specified.
 - 2) Qualifications in error.

6.3.2.11 Personnel and Training Requirements

Record the following:

- a. The most appropriate skill levels and experience (background) suggested for operator and maintenance personnel.
- b. Any suggested changes to training techniques, literature, etc., to eliminate operator errors or reduce maintenance time.

c. Each additional training technique utilized after the start of testing and suggestion for additions or deletions to the training program.

d. The training time, in hours, for maintenance and operating personnel.

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Target Positional Accuracy

Analyze test data and compute the error between indicated position of the target and the actual position at landmark passage.

6.4.2 Target Resolution

Analyze all test data to determine the effects of target properties on resolution.

6.4.3 Field of Coverage

Compare the indicated field of coverage with stated system specifications and determine the error.

6.4.4 Target Characteristics/Environment

Analyze test data and summarize by showing against which types of targets the system is most and least effective.

6.4.5 Effect of Atmospheric Conditions

Summarize the test data by discussing system performance as a function of conditions emphasizing those conditions under which the system became inoperable or inaccurate.

6.4.6 Effects of Geographic Surface Conditions

Analyze the test data and summarize the system's performance over various types of surfaces.

6.4.7 Durability

Analyze the recorded data and summarize the degradations in equipment that indicate lack of durability.

6.4.8 Maintainability

From the recorded data compute the maintenance downtime and mean time to repair (reference 4.F).

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6.4.9 Reliability

From the recorded data compute the failure-free operating time and mean time between failures (reference 4.F).

6.4.10 General

a. The remainder of the data will be summarized as appropriate. Photographic records will be positively identified. The total data will be analyzed to determine to what degree the system and its maintenance package meet the requirements of OMR, SDR, TC, and detailed military specifications. Record all shortcomings or deficiencies.

b. The data will also be further analyzed, where appropriate, to determine the extent to which the system under test exceeds the performance characteristics or otherwise provides distinct advantages over existing Army equipment providing for the same requirements. Provide a recommendation as to the suitability of the system and its maintenance test package for use by the Army.

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